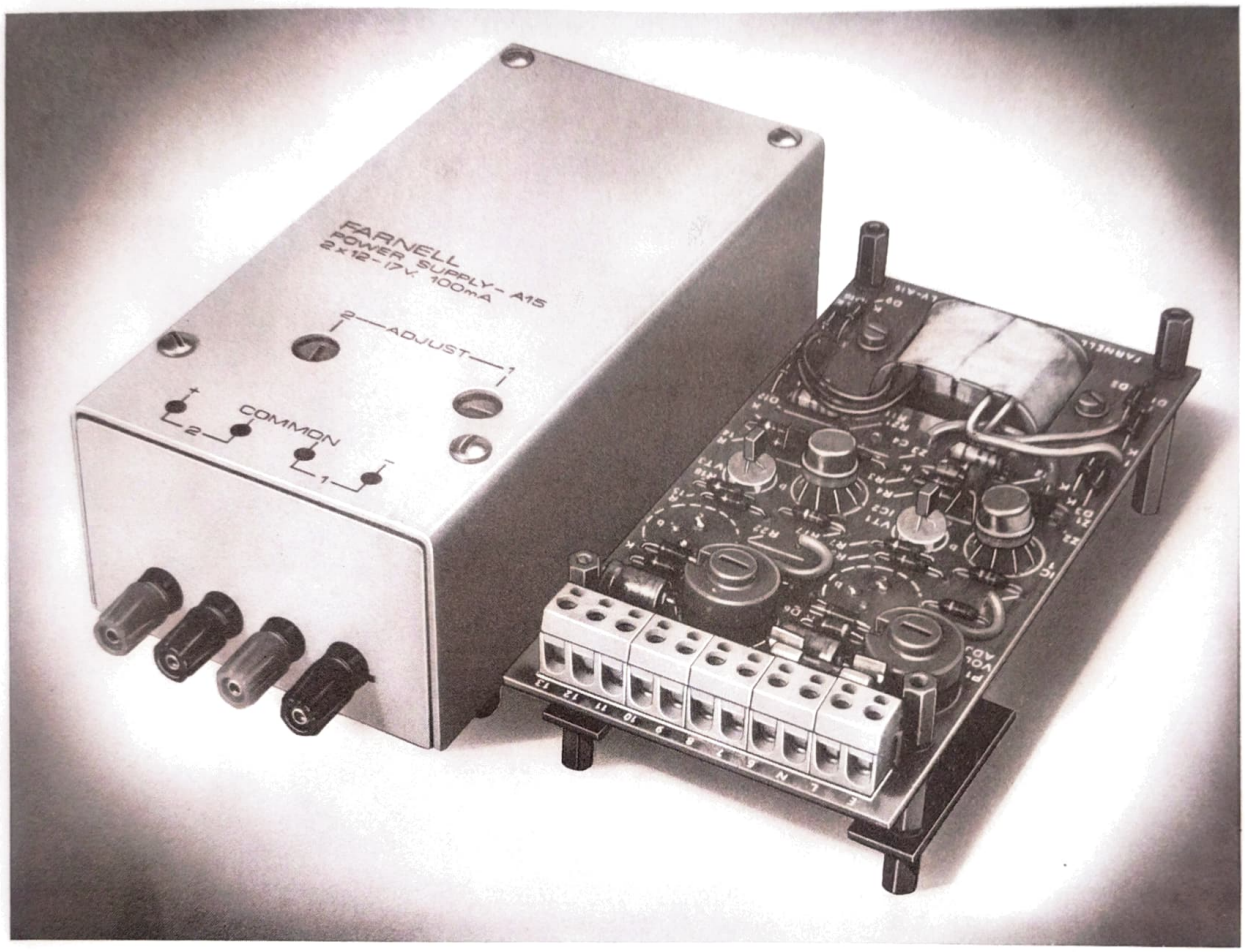
Publication P85

Farnell

A15 operational amplifier power supply



Dual output
15-0-15V at 100mA

Available in card form
or complete

The A15 is a twin output power supply intended primarily for driving operational amplifiers. The outputs, nominally 15-0-15V, 100mA, can be varied over the range 12-17V or connected in series to provide 24-34V. Two controls are available giving ganged control of both outputs and independent control of one of them.

The unit can be purchased complete with cover, feet, mains lead and terminals or as a printed circuit card with fixing studs as illustrated.

Specification

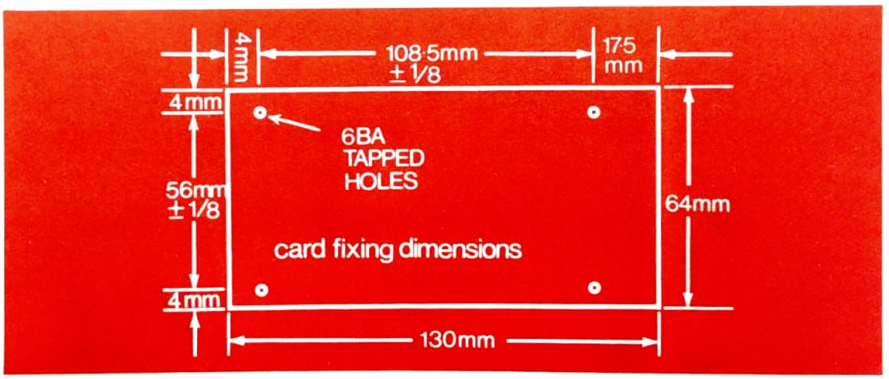
Mains input	220-240V, 50-400 Hz 105-120V, to special order
Mains variation tolerated	±10%
Output	Nominally 15-0-15V d.c. at up to 100mA
Output voltage adjustment	Two controls — 1) ganged outputs 2) independent control of one output Variation — 12-17V
Line regulation Output change for a ±10% mains change	Less than 2mV (for either output)
Load regulation Output change for a zero to full load change	Less than 2mV (0/P1) 10mV (0/P2)
Ripple and noise content at full load (△ f = 80kHz)	Less than 2mV pk-pk (0/P1) 5mV pk-pk (0/P2)
Transient recovery time typical	Less than 30μS for output to recover within 50mV following a full load change of 1μS risetime
Output impedance typical	Less than 0·1 Ω at 1kHz and 25°C
Temperature coefficient typical	0.02% per °C
Operating temperature range	−10°C to +60°C (40°C (for cased version)
Storage temperature range	−40°C to +85°C
Overload protection	Cut-back current limit and mains fuse

Dimensions

Card form
Height 38.1mm (1.5″)
Width 64 mm (2.5″)
Depth 130 mm (5.15″)
Weight 0.34 kg (12oz.) approx.

Complete unit
Height 47 mm (1.85″) including feet
Width 67.5 mm (2.65″)
Depth 153 mm (6.1″) including terminals*
Weight 0.4 kg (14 oz) approx.

*Belling-Lee L1726 2mm. Use L1727 2mm plug or angled entry type L1736.



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FARNELL INSTRUMENTS LIMITED

INSTRUCTION MANUAL

A15 STABILISED POWER SUPPLY UNIT

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SECTION 1

INTRODUCTION

The A15 stabilised power unit is a twin output supply the outputs being connected in series to give a positive and negative output with respect to their common zero connection.

The output voltage of either supply can be varied by means of the preset potentiometers between 12 and 17V at a maximum current of 100mA.

Overload protection is provided by current limiting circuitry which reduces the output current on short circuit, but allows automatic voltage resetting when the overload is removed.

The unit will accept mains inputs of 210–240 volts 50–400Hz and a fuse is fitted as additional protection.

SECTION II

OPERATION

All connections are made to the 11-way connector block on the edge of the circuit board.

Connection to the mains supply is via the connectors marked E, L and N (Earth, Live and Neutral).

D.C. output is taken from the remaining connectors as follows :—

(i) Output 1.

Function	*Connector No.*
O/P Negative	6
F/B Negative	7
O/P Positive	8
F/B Positive	9

(ii) Output 2.

O/P Negative	10
F/B Negative	11
O/P Positive	12
F/B Positive	13

For normal operation Pins 6 and 7 should be linked, Pins 8, 9, 10 and 11 should be linked, and Pins 12 and 13 should be linked. The output connections are then :- Pin 6, negative output, Pin 8 or 10 common zero, and Pin 12 positive output.

Pins 8 and 10 should be linked for this connection to provide the common zero line.

Feedback terminals are provided to correct for voltage drop along the connecting leads. Connections should be made from the remote end of the negative lead to the appropriate F/B negative connector and similarly from the remote end of the positive lead to the appropriate F/B positive connector.

The control marked "O/P 1 Adjust" varies output 1 directly whilst varying output 2 by a proportional amount. The "O/P 2 Adjust" control varies only output 2. Thus the "O/P 1 Adjust" control varies both outputs simultaneously and the "O/P 2 Adjust" control varies the difference between the two outputs. The procedure for setting output voltage is therefore (a) Set O/P 2 voltage by the Output 1, adjust potentiometer and then (b) Set O/P 2 voltage by the output 2, adjust potentiometer. Each output may be set within the range 12–17 volts.

N.B.—Although more adjustment is available, for correct operation neither output should be set outside these limits.

The current limit point is fixed and is in excess of 100mA.

SECTION III

CIRCUIT DESCRIPTION

OUTPUT 1.

The circuit employs a series regulator transistor driven from an integrated circuit differential amplifier which compares the voltage of a zener diode reference with a proportion of the output voltage, derived from a resistive potential divider.

The mains supply is connected to transformer MT1 via the input connector block and fuse F1. The secondary winding supplies a bridge rectifier, reservoir capacitor system which provides the unregulated D.C. line. The positive line is connected via the series regulator transistor to the positive output connector and the negative line to the negative output connector.

The unstabilised line is fed to zener diode Z1, via resistor R2, which provides positive voltage at the junction of R2, Z1 and D5 with respect to the feedback negative line. This causes D5 to conduct making the non-inverting input (pin 3) of the differential amplifier I.C.1 positive with respect to the feedback negative line. This applies a differential input to I.C.1 in such a sense as to cause the output of I.C.1 to rise positively. This positive signal is passed to the series regulator transistor VT2 via R4 and causes VT2 to conduct. Thus the output voltage rises to a sufficient level as to cause Z2 to conduct (since it is connected to the feedback positive line via R3) and the voltage at the wiper of P1 (connected to the inverting input of I.C.1) is equal to the zener voltage of Z2. Since the zener voltage of Z2 is higher than that of Z1, D5 is now non-conducting. Any change in output voltage produces a change at the wiper of P1 which feeds a signal to I.C.1 in such a sense as to oppose the original change in output voltage. Thus the action of the loop is to maintain zero signal, between the inverting (pin 2) and non-inverting (pin 3) inputs of I.C.1. Thus output voltage is determined by the ratio of the potential divider R8, P1 and R9 (i.e. the setting of P1).

Overload protection is provided by VT1, its emitter being connected to the O/P positive line and its base to the emitter of VT2 via the potential divider R5 and R6.

As output current increases, the voltage across R7 increases causing the voltage at VT1 base to rise positively with respect to its emitter until VT1 starts to conduct. This diverts drive current from VT2 base and the output current limits. Further increase in load causes the output voltage to fall causing the voltage at VT1 base to become more positive due to the action of potential divider R5 and R6. Thus VT1 conducts harder reducing the drive to VT2 still further and the output voltage continues to fall. With increasing overload the action of the circuitry is to reduce the output current until at short circuit it is at a safe value determined by R5, R6 and R7.

OUTPUT 2.

The circuit operates in the same manner as that of supply 1, in all respects except that the input to the non-inverting input to I.C.2 is via potential divider R12 and R13 connected between the output positive line and the feedback negative line and the bottom leg of potential divider R16, P2 and R20 (i.e. R20) is connected to the feedback negative line of supply 1.

As the output voltage of supply 1 rises, the feedback negative line falls negatively with respect to the feedback negative line of supply 2, leading a negative signal to the inverting input of I.C.2, producing a signal at its output rising positively. This causes VT4 to conduct and the output voltage rises until the voltage at the non-inverting input (pin 3) derived from potential divider R12 and R13 is equal to the voltage at the inverting input (pin 2) of I.C.2. Any change in output 1 produces a proportional change in the voltage level at the inverting input (pin 2) of I.C.1 by the potential divider action of R16, P2 and R20, which causes output 2 to change by a proportional amount to keep the voltages at the inverting (pin 2) and non-inverting (pin 3) inputs of I.C.2 equal. Thus output 2 is "ganged" to output 1 and the difference in output voltage between the two outputs can be varied by varying P2.

As can be seen from the circuit diagram provision has been made to make supply 2 identical with supply 1, in which case the circuit operates in the same manner and can be operated completely independently of supply 1.

SECTION IV

SPECIFICATION

MAINS INPUT

220–240V, 50–400Hz.

OUTPUT VOLTAGE.

+ 12 to 17 – 0 – — 12 to 17 volts.

MAXIMUM OUTPUT CURRENT.

100mA.

MAINS VARIATION TOLERATED.

200–265 volts.

OUTPUT CHANGE FOR

± 10% Mains Change (Short Term).
Less than 2mV (Output 1).
Less than 2mV (Output 2).

OUTPUT CHANGE FOR O-FULL LOAD CHANGE (Short Term).

Less than 2mV (Output 1).
Less than 10mV (Output 2).

RIPPLE VOLTAGE AT FULL LOAD

Less than 2mV pk.-pk. (Output 1).
Less than 5mV pk.-p.k. (Output 2).

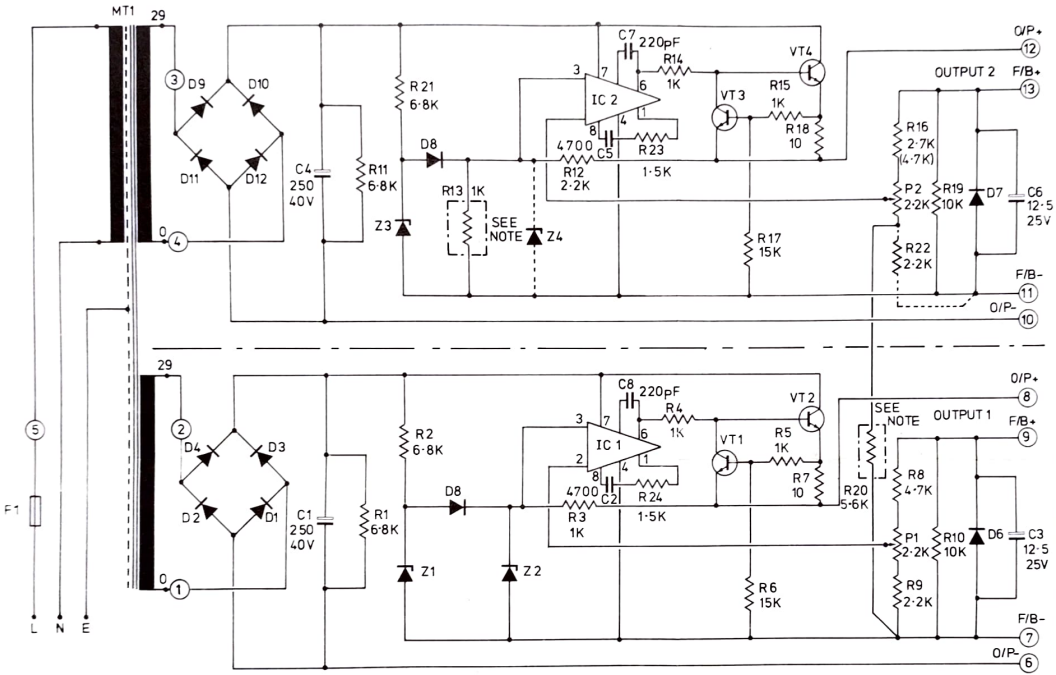
OVERLOAD PROTECTION

Current limiting with reduction of output current on increasing load.

MAXIMUM OPERATING TEMPERATURE

Uncased 60°C.
Cased 40°C.

DRAWING No. 3-3556																			
USED ON	R		11,1	21,2	13		12,3	23,24, 14,4		17,6	15,5	18,7	20	16,22,8,9,19,10					R
	C	1,4				2,5	7,8								3,6				C
	VT								1,3		2,4								VT
	MISC	F1	MT1	D1-4, D9-12		Z1,3	D5,8	Z2	Z4	IC1,2				P1,2		D6,7			MISC



NOTE-FOR TWIN OPERATION FIT COMPONENTS SHOWN DOTTED, REMOVE R13 & R20 ALSO CHANGE R16 TO BRACKETED VALUE

CIRCUIT DIAGRAM KEY

COMP NO.	QUANTITY	MANUFACTURER	TYPE NO.	RATING	TOLERANCE
R1 TO R10	1 EACH	ELECTROSIL	TR5	1/4W	5%
R11 TO R22	1 EACH	ERIE	MO4	1/8W	5%
C1	1	MULLARD	C437AR/G250	40V	
C2	1	ERIE	8111-025	30V	
C3	1	MULLARD	C426AR/F125	25V	
C4	1	MULLARD	C437AR/G250	40V	
C5	1	ERIE	8111-025	30V	
C6	1	MULLARD	C426AR/	25V	
C7	1	ERIE	STYLE831	500 d.c.	
C8	1	-	-	" "	
D1-D4	1 EACH	WESTING HOUSE	384D		
D5	1	TEXAS	1N659		
D6	1	WESTING HOUSE	384D		
D7	1	-	-		
D8	1	TEXAS	1N659		
D9 TO D12	1 EACH	WESTING HOUSE	384D		
Z1	1	S.T.C.	ZF3·9		
Z2	1	EMI-HUS	HS2051		
Z3	1	S.T.C.	ZF3·9		
Z4	1	EMI-HUS	HS2051		
VT1	1	TEXAS	BC182L		
VT2	1	R.C.A.	2N3053		
VT3	1	TEXAS	BC182L		
VT4	1	R.C.A.	2N3053		
IC1	1	S.G.S.	uA709C		
IC2	1	-	-		
P1	1	PLESSEY	WMP		
P2	1	-	-		
MT1	1				
F1	1	BESWICK	TD134	100MA	AS

N.B C2, C5, C7, C8, R23, R24, ARE NOT REQUIRED WHEN uA741C IS USED

NOTE! ALTERNATIVE COMPONENTS TO THE ABOVE MAY BE USED IN EVENT OF SUPPLY DIFFICULTIES

TRACED							
CHECKED							
DRAWN	ISS.	DATE	MOD No.				
B L G	5	22:7:71	852				

NOTE!
CAPACITOR VALUES GIVEN IN µF
RESISTOR VALUES IN Ω
(2) REFERS TO CCT BD PIN CONNECTION Nos.

TOLERANCES	PROTECTIVE FINISH
MATERIAL	DIMENSIONS IN M.M.

FARNELL INSTRUMENTS LTD. WETHERBY, YORKS.

TITLE: CIRCUIT DIAGRAM and KEY A15

DRAWING No. 3-3556

SHEET 1 OF 1 SHEETS